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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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S-215R

June 1970

U.S. Training and
Employment Service
Technical Report
S-215R

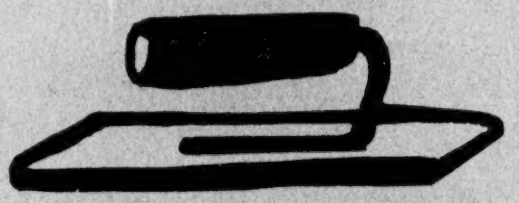
Development of USTES

APTITUDE TEST
BATTERY FOR

CEMENT MASON

(const.)
844.884

U.S DEPARTMENT OF LABOR
Manpower Administration



TM 001 728

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Cement Mason (const.) 844.844

S-215R

(Developed in Cooperation with the
Ohio State Employment Service)

U. S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2351

Development of USTES Aptitude Test Battery

For

Cement Mason (const.) 844.844-014

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Cement Mason (const.) 844.844-014. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	70
S - Spatial Aptitude	70
M - Manual Dexterity	85

Research Summary

Sample:

52 male workers employed as Cement Masons in Ohio.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi coefficient = .36 ($P/2 < .005$)

Effectiveness of Norms:

Only 63% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 80% would have been good workers. Thirty-seven percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 20% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	63%	80%
Poor Workers	37%	20%

SAMPLE DESCRIPTION

Size:

N = 52

Occupational Status:

Employed Workers.

Work Setting:

Workers were members of the Cement Masons Union Local No.524 in Cincinnati, Ohio.

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least three years job experience. (Journeyman status in this occupation requires the successful completion of a three year apprenticeship.)

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience.

	Mean	SD	Range	r
Age (years)	36.2	8.1	20-59	-.054
Education (years)	10.3	1.7	7-15	.324*
Experience (months)	129.8	68.8	36-372	.098

*Significant at the .05 level.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A were administered on October 22, 1960.

CRITERION

The job description was reviewed with the Business Agent of the Union and five rating items were developed to provide measures of important aspects of the job. The Business Agent rated and rerated each individual on each item. The numerical rating scale for each item was 1-3; the minimum total rating scale score was 5, and maximum total score was 15. The total rating scale scores for each set of ratings were divided into three broad categories and numerical scores were obtained for each category. The final criterion consisted of the average numerical broad category score for each individual.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 37% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 46.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required for learning subjects taught in apprentice training courses.
N - Numerical Aptitude	Required for computation of lengths, widths, heights, angles, volumes, etc., necessary for layout and construction of forms and screeds.
S- Spatial Aptitude	Required for training in architectural drawing and for reading construction drawings and blueprints.
P - Form Perception	Required for making visual discriminations necessary while constructing and positioning forms and screeds and while performing leveling and finishing operations.
M - Manual Dexterity	Required for hand-arm movements necessary in constructing and setting-in-place screeds and forms and in leveling and finishing operations.

On the basis of the job analysis data, V-Verbal Aptitude is considered obviously unimportant for performing the duties of this job and is considered an "irrelevant" aptitude.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

	Mean	SD	Range	r
G - General Learning Ability	84.1	17.1	55-118	.412**
V - Verbal Aptitude	83.0	15.5	61-129	.296*
N - Numerical Aptitude	78.6	18.7	39-115	.393**
S - Spatial Aptitude	90.0	18.5	51-124	.317*
P - Form Perception	82.5	22.0	38-138	.397**
Q - Clerical Perception	83.8	13.6	58-114	.251
K - Motor Coordination	90.7	18.4	43-136	.390**
F - Finger Dexterity	84.0	23.4	25-145	.339*
M - Manual Dexterity	100.6	19.9	58-144	.446**

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X	X	X				X
Irrelevant		X							
Relatively High Mean				X			X		X
Relatively Low Standard Dev.						X			
Significant Correlation With Criterion	X	X	X	X	X		X	X	X
Aptitudes to be Considered for Trial Norms	G		N	S	P		K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, N, S, P, K, F, and M at trial cutting scores were able to differentiate between the 63% of the sample considered to be good workers and the 37% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. Norms of N-70, S-70 and M-85 provided optimum differentiation for the occupation of Cement Mason (const.) 844.844-014. The validity of these norms is shown in Table 6 and is indicated by a phi coefficient of .36 (statistically significant at the .005 level).

TABLE 6

Concurrent Validity of Test Norms
N-70, S-70 and M-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	24	33
Poor Workers	13	6	19
Total	22	30	52

Phi coefficient = .36 Chi Square (X^2_ϕ) = 6.8

Significance level = P/2 < .005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for the study met the requirements of incorporating the occupation studied into OAP-37 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .21 is obtained with the OAP-37 norms of N-80, S-95 and M-85.

June 1970 S-215R

FACT SHEET

Job Title

Cement Mason (const.) 844.844-014

Job Summary

Measures linear distances to locate boundaries of concrete work. Constructs, places, and anchors required screeds and forms. Works cement mixes to produce specified surface shape, grade, and texture, using a variety of hand and power tools. Renovates and repairs concrete surfaces by chipping, grinding, patching, and applying special surface coatings.

Work Performed

Establishes grade lines and heights: Determines exact location and contour of concrete work from construction drawings. Selects established points or lines to be used as references from which measurements are taken to locate surfaces of concrete work. Calculates any required dimensions not shown on drawings. Measures, at job site, pre-determined linear distances from reference points using instruments such as measuring tapes, plumb bobs, protractors, levels, and squares. Drives stakes or marks existing surfaces to indicate location of concrete surfaces.

Constructs and sets-in-place screeds and forms: Determines number and type of forms and screeds needed to form or guide the forming of work to specified size and shape. Constructs wooden forms and screeds by measuring, cutting, and nailing together boards using carpenters' tools such as hand saws, hammers, squares, and mitre boxes. Sets-in-place wooden forms and screeds of prefabricated steel forms, if used. (Forms that are more than one board high or that deviate from simple straight or curved line construction are constructed and set in place by carpenters.) Anchors forms and screeds firmly in place by backing-up forms at ground level with stakes driven into the ground or by constructing wood bracing back of the forms. May spray or brush lubrication forms and screeds to prevent concrete from bonding to them.

Pours and supervises preliminary leveling of cement mix: Observes and instructs laborers pouring cement mix to insure that required quantity, placement, and preliminary leveling is obtained. May tamp or vibrate cement mix with hand or power tools to remove air bubbles from mix whenever strong, dense concrete is specified.

Levels cement mix: Slides a straight edged tool in a saw-like motion across the surface of the cement mix, using screeds as guides, to reduce it to specified grade. Pulls metal or wood template across cement to produce curved surfaces such as curbs and coves. Rubs surface with float to remove high spots and depressions.

Applies surface finish: Determines that concrete has reached proper stage for applying surface finish by observing surface appearance which becomes dull as water evaporates. Works hand or powered wood or metal float or brush across surface to provide specified surface texture. May pull special grooving or edging tools along surface or edge of concrete to provide specified joint or edge conditions. May wet surface of concrete and/or cover with waterproof paper after applying finish to retard water evaporation.

Grinds hardened concrete surfaces to produce uniform texture by rubbing surface with abrasive stones or using electric grinder. Prepares cement-sand mix and applies to surface with trowel to fill unwanted depressions. Brushes or trowels mix on entire surface when required by specifications.

May apply special coatings to concrete, with either a brush or a trowel, to provide a colored, sealed, waterproofed, sound absorbing, or chemical or abrasion resistant surface.

Patches defective concrete: Chips out defective concrete using hammer and chisel or air-hammer. May use powered masonry saw to obtain even edges. Prepares or directs preparation of cement-sand mix. Fills, levels, and finishes cement mix as detailed above.

Effectiveness of Norms

Only 63% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-215R norms, 80% would have been good workers. Thirty-seven percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-215R norms, only 20% would have been poor workers.

Applicability of S-215R Norms

The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.818

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